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NEW SERIES, No. 79. SEPTEMBER, 1907.

THE DEWEY REPORT ON WAGES IN MANUFACTURING INDUSTRIES IN THE UNITED STATES.

By A. E. James.

I.

The Twelfth Census Special Report on Employees and Wages, which forms the subject of this article, is not, like the regular census publications, a summary covering the entire field of manufactures. As its name implies, it is a "special report," the result of a special investigation made under the direction of Professor Davis R. Dewey. For the sake of brevity and in appreciation of a report which marks a new departure and a long advance in American statistics of wages, it will be referred to in the following pages as the "Dewey Report."

Professor Dewey's investigation was limited to thirty-three manufacturing industries and to only a small proportion of the establishments in those industries. Thus wage statistics were secured for only a small part of the total number of wage-earners actually engaged in American manufactures. Table I shows the number of adult males engaged in all manufacturing industries from which the Dewey Report gives statements of wages, the total number of adult males whose rates of wages were actually returned, and the per cent. which this last total is of the whole number in the industries investigated and of the total number in all manufacturing industries in the whole country for 1890–1900.

TABLE I.

ADULT MALE WAGE-EARNERS (*a*) IN THE UNITED STATES, (*b*) IN THE INDUSTRIES GIVEN IN THE DEWEY REPORT, (*c*) IN THE DEWEY REPORT ITSELF, AND WITH PERCENTAGES AS INDICATED.

Years.	(*a*) Number Employees in all Manufactures.	(*b*) Number Employees in Dewey Industries.	Percentage Employees in Dewey Industries to Total in all.	(*c*) Number Employees whose Rates were investigated.	Percentage.	
					c to *b*	*c* to *a*
1890	3,327,042	1,788,966	53.77	105,453	5.89	3.17
1900	4,110,527	2,232,509	54.31	160,859	7.20	3.91

As in all restricted investigations, we are here met at the outset with the question, Are these returns representative? Little more than half the total of all manufacturing wage-earners are included in the thirty-three industries, and of these the returns of wage rates were secured from only a small percentage of the total number of employees. Numbers, however, are an indifferent test. It would seem that an investigation which included 3 to 4 per cent. of all the wage-earners in manufactures in the country should give an excellent idea of manufacturing wages, as a whole. But in the first place the industries selected must cover the whole range of our national manufactures, and, more important still, must include those broadly typical of the whole. Table II gives a list of the industries from which data were secured by Professor Dewey, and the percentage of all employees in each industry whose wage rates were actually returned, 1890–1900.

TABLE II.

INDUSTRIES IN THE DEWEY REPORT AND PERCENTAGE OF ADULT MALE EMPLOYEES IN EACH INDUSTRY ACTUALLY RETURNED, 1890-1900.

Industries.	1890.	1900.
Textile industries:		
Carpet mills	5.59	6.10
Cotton mills	3.24	3.28
Knitting mills	1.89	2.17
Dyeing and finishing textiles	10.76	11.07
Woollen mills	8.51	11.35
Wood-working industries :		
Agricultural implements	10.38	25.90
Furniture	3.79	3.96
Lumber and planing mills	2.84	3.46
Pianos	6.76	9.69
Wagons and carriages	3.26	3.42
Metal-working industries:		
Car and railroad shops	4.34	5.05
Foundries and metal-working	10.14	11.27
Iron and steel mills	11.43	11.55
Shipyards	19.05	17.93
Miscellaneous industries:		
Bakeries	3.11	3.02
Breweries	10.59	9.54
Candy	3.16	3.61
Chemicals	27.77	25.09
Cigars	1.17	1.71
Clothing	.56	.89
Collars and cuffs	8.60	10.54
Distilleries	2.59	5.27
Flour mills	2.19	3.83
Glass	7.69	10.62
Paper mills	3.74	3.09
Potteries	2.61	1.66
Brickyards	.27	.40
Printing	2.79	2.41
Rubber	22.07	11.04
Shoes	1.50	2.39
Slaughtering	21.47	13.43
Tanneries	6.10	9.10
Tobacco	32.38	28.33

This list of industries seems to have been chosen with great care, and ought to be fairly representative of the whole manufacturing field. We have already seen (Table I) that the percentage of adult male wage-earners whose rates of wages were actually investigated to the total number of wage-earners in manufactures was in 1890 3.17 per cent. and in 1900 3.91 per cent. So general an average as this is, however, likely to mislead. An investigation of a statistical nature is peculiarly liable to err, if the several parts are not in themselves representative. Data that are faulty not only are worthless in themselves, but carry their weaknesses through all summaries and into all results. Unlike mere mechanical errors of tabulation, these errors in collected data are unlikely to be self-correcting. It is, therefore, necessary that each of the various industries treated in the Dewey Report should have returns large enough to fairly represent that industry. Table II A is a summary for all the industries, showing the number of industries in each of several percentage groups and indicating in a general way to what extent the Dewey Report may be considered to be representative of all the industries investigated.

TABLE II A.

THE NUMBER OF INDUSTRIES GROUPED ACCORDING TO THE PERCENTAGE OF EMPLOYEES IN EACH WHOSE WAGE RATES WERE RETURNED.

Groups of Percentages.	1890.	1900.
All groups	33	33
Under 1%	2	2
1% to 1.99%	3	2
2 " 2.99	5	3
3 " 4.99	7	8
5 " 9.99	6	6
10 " 19.99	6	9
20% and over	4	3

Mr. Arthur L. Bowley, one of the greatest authorities on wage statistics in any country, attacked the report in a recent number of the *Royal Statistical Journal,* one of his points being that Professor Dewey had not reported as many as a thousand employees in several industries. But surely the only fair test is the percentile test already applied, and by this test the Dewey Report seems in vastly the greater part to be sufficiently representative of each industry.

But quite as important as this is the question of geographical distribution. It will be remembered that the Aldrich Report was confined almost exclusively to New England and the Middle Atlantic States. This was clearly unfortunate. The economic sections of the country are widely different, and no report can possibly represent conditions or even relative changes without carefully considering each section in nearly its relative importance to the manufacturing wage-earning class. For the Dewey Report establishments of the various industries were selected from every section of the country, and it only remains to be seen whether more or less wage-earners were selected in any section than should have been to satisfy the requirements of reasonable accuracy. In Table III are given the percentages of the total number of wage-earners in the country distributed by sections as returned by the Census Report of Manufactures, Part I, and the percentage of the total number in the Dewey Report taken from each section.

TABLE III.

THE DISTRIBUTION OF ADULT MALE WAGE-EARNERS BY GEOGRAPHIC DIVISIONS.

Geographic Divisions.	1890.		1900.	
	Census Report.	Dewey Report.	Census Report.	Dewey Report.
United States	100.0	100.0	100.0	100.0
New England States	19.3	12.1	17.8	10.5
Middle States	38.5	36.4	37.2	36.0
Southern States	9.7	7.1	12.3	6.2
Central States	28.2	40.3	27.7	42.3
Western States	1.8	0.0	2.3	0.0
Pacific States	2.5	4.1	2.7	5.0

From this table it appears that, geographically considered, Professor Dewey's selection of wage-earners is only fairly representative. The Middle States and the West, as a whole, are given proper weight, but New England and the Southern States are somewhat neglected, while the Central States are noticeably over-represented. The question immediately arises, has this defect in the selection of data appreciably influenced the results of the investigation? This question may be answered by a simple test. The Census of Manufactures provides us average wages in different sections of the United States, as follows:—

	1890.	1900.
New England States	$509.33	$507.12
Middle States	540.62	528.71
Southern States	364.83	334.96
Central States	470.84	488.51
Western States	565.91	577.09
Pacific States	620.39	577.11

These averages, though inaccurate for some purposes, are sufficiently accurate to show whether a general average based upon them and weighted by the actual proportions of wage-earners in the several sections of the country would differ materially from a similar general average weighted by the proportions which characterized Professor Dewey's selection. The results of this test (Table IV) show that in 1890 the average weighted according to the true proportions differs from the average weighted according to Professor Dewey's proportions by only ten cents. In 1900, however, the over-weighting of the Central Division is shown to have exercised an appreciable influence. It appears above that the only important manufacturing section of the country showing an increase is the Central States.

TABLE IV.

Weights.	1890.	1900.	Percentage of Excess.
Census proportions	$499.60	$492.32	Dewey over Census 1900, 1.53%
Dewey proportions	499.50	499.85	

In short, from these results it seems fair to conclude that Professor Dewey presents a somewhat too favorable picture of conditions in 1900.

Professor Dewey's investigation, while made in 1901–02, included two years within its scope; namely, 1890 and 1900. The method of securing the comparison was, briefly, this: The men engaged in field work were restricted in securing data to those industries and establishments which were in existence at both these dates. They then copied from the pay-rolls of these establishments the number of employees and their respective rates of wages in each year. This was done apparently upon the theory that the thing desired was an index of the *change* in wages. Any broad, general movement would doubtless be fully revealed by this method; but, if the thing which we would measure is the *social well-being of the laboring class*, is the method correct? Should not new establishments and new industries which arise be given their full representation? Doubtless their competition in the labor market will have its effect upon the industries and establishments already existing, but we cannot depend wholly upon the "fluidity" of labor. If our returns are to have any social meaning, if they are to fulfil the fundamental purpose of wage statistics, they must be for each year broadly representative, not merely of particular industries and establishments, but of manufactures as a whole. Therefore, the exclusion of any data necessary for the above purpose merely because it was not included at some prior date defeats the very object for which the investigation was made. In each year we must have returns broadly representative. Then we will let the comparisons take care of themselves. The Dewey Report, however, covered so broad a field and was so thoroughly representative in that field that this error probably had little influence upon the results obtained. That the idea itself was misconceived should, I think, clearly appear from the fact that, if rigidly and logically adhered to, it should be applied not merely to industries and establishments, but also to occupations and individuals! Such a rule would, of course, be a practical impossibility. But suppose the present method be persisted in. In a few decades the constant changes of occupations, firms, and establishments, and even industries to which our manufactures are subject, would gradually exhaust all our available data. It may be suggested that in each census a comparative study may be made, covering, as did Professor Dewey's, two *census* years. I would answer, first, that such a study is expensive; second, that it is either useless or breaks the continuity of the statistics from decade to decade; and, third, that it is wrong in principle. The end to be attained is a true picture of wages in each decennial year, and all methods not necessarily conducive to that end are of doubtful value.

Finally, it has been frequently stated, and nowhere more emphatically than in the Census Reports, that the wages of skilled and unskilled workmen cannot be averaged, that no single index number or average can be obtained in which is summed up the whole condition and trend of wages, that comparisons of the whole wage-earning class from one period to another are necessarily based upon the assumption that there has been no change in the proportions of the skilled and unskilled. Professor Dewey opens his discussion with a quotation from Part I, page cxii, of the Census of Manufactures, in which is this statement: "An average obtained by dividing the number of wage-earners into the total amount of wages paid is misleading. The argument that such an average is serviceable for purposes of comparison from one period to another must presuppose that the proportion of skilled and unskilled labor at the two periods for which the average is returned remains substantially the same." This is doubtless true of an arithmetic average, but not because of the problem of handling statistics of skilled and unskilled wage-earners. It is not necessary here to treat of the weakness of the arithmetic average in wage statistics. But, when it is once obtained and used, why may not changes in the proportions of skilled and unskilled enter into the calculations, just as any other cause which may bring about a general change in the rates of wages? Surely, if the welfare of the wage-earning class is the thing we are investigating, an increase or a fall in the demand for *skilled* workmen, any change in the proportion which they bear to the whole, is as much to be taken into account as the demand for labor itself or a change in the prosperity of the country.

II.

We have seen that the Dewey Report, while imperfect in some respects, is yet, on the whole, probably the most reliable report on wages in the United States. Its strength lies mainly in the two facts (1) that it is broadly extended over every kind of manufacturing and includes enough wage-earners to be representative, and (2) that the data are presented in practically their original form. Moreover, the averages obtained (the median and quartiles) are far preferable to a mere index number or arithmetic average which give no indication of the welfare of the various wage groups, no idea of changes in relative distribution, and no data from which these things may be computed. The great fault to be found with the Dewey Report, aside from the questions of method already treated, is that no final results were obtained in the investigation as a whole. Each industry was briefly summarized, and there the discussion stopped. The wage-earners in each industry were first divided into 50-cent groups of weekly wage rates, and then assigned to their particular occupational group. These were, in turn, gathered together by sections of the country, and finally a grand total found for the entire industry in the whole country. This summary was perfectly right. *So long as our data are preserved in their original form, or in small groups, it is immaterial to what extent we combine establishments or industries,* since it is the wage obtained, and not the nature of the work done, which is of importance to us in dealing with wage statistics. This being the case, a final summary grouped as were all the others, showing the distribution of wage-earners in wage groups in all the industries for the whole country, might well have been obtained.

This, then, is the first thing to be done in a study of the Dewey Report, the object of which is to find the wages prevailing in manufacturing industries in the United States in 1890 and 1900. The method here used is simply that indicated above. The summaries for each industry as divided into wage groups are added together, thereby getting a grand total for all the industries covered by the report. Table V contains the results so obtained, with their cumulative and absolute per cents. for 1890 and 1900.

Where possible, a graphic representation of statistics is always desirable, as it brings out most clearly the essential points of the phenomena with which we have to deal. For the present purpose I have used a cumulative percentile curve, plotting upon one co-ordinate the cumulative per cents. given above and upon the other the wage groups to which they correspond. This curve has several advantages over other graphic methods for our particular purposes. In the first place the use of the cumulative per cents. locates automatically the median, quartiles, and other desired percentile points, and the curves for different years may be plotted together and their points of variation noted at a glance.

TABLE V.

SUMMARY FOR ALL INDUSTRIES. DISTRIBUTION OF ADULT MALE WAGE-EARNERS IN WAGE GROUPS.

Rates per Week.	1890.			1900.		
	Number.	Absolute per Cents.	Cumulative per Cents.	Number.	Absolute per Cents.	Cumulative per Cents.
Total	105,453	100.00	100.00	160,859	100.00	100.00
Under $2.00 . . .	30	.03	100.00	21	.01	100.00
$2.00 to $2.49 . . .	164	.16	99.97	108	.07	99.99
2.50 " 2.99 . . .	280	.27	99.81	484	.30	99.92
3.00 " 3.49 . . .	1,210	1.15	99.54	1,141	.71	99.62
3.50 " 3.99 . . .	1,132	1.07	98.39	1,535	.95	98.91
4.00 " 4.49 . . .	1,625	1.54	97.32	1,754	1.09	97.96
4.50 " 4.99 . . .	2,105	2.00	95.78	2,598	1.62	96.87
5.00 " 5.49 . . .	1,783	1.69	93.78	2,482	1.54	95.25
5.50 " 5.99 . . .	958	.91	92.09	1,416	.88	93.71
6.00 " 6.49 . . .	3,762	3.57	91.18	4,795	2.98	92.83
6.50 " 6.99 . . .	2,681	2.54	87.61	3,169	1.97	89.85
7.00 " 7.49 . . .	3,818	3.62	85.07	6,289	3 91	87.88
7.50 " 7.99 . . .	5,738	5.44	81.45	9,495	5.90	83.97
8.00 " 8.49 . . .	6,256	5.93	76.01	8,998	5.59	78.07
8.50 " 8.99 . . .	1,934	1.83	70.08	4,263	2.65	72.48
9.00 " 9.49 . . .	9,508	9.02	68.25	16,319	10.15	69.83
9.50 " 9.99 . . .	2,949	2.80	59.23	7,487	4.65	59.68
10.00 " 10.49 . . .	3,816	3.62	56.43	5,299	3.29	55.03
10.50 " 10.99 . . .	10,817	10.26	52.81	12,820	7.97	51.74
11.00 " 11.49 . . .	2,426	2.30	42.55	4,515	2.81	43.77
11.50 " 11.99 . . .	1,786	1.69	40.25	2,887	1.80	40.96
12.00 " 12.49 . . .	7,347	6.97	38.56	11,126	6.92	39.16
12.50 " 12.99 . . .	1,694	1.61	31.59	4,385	2.73	32.24
13.00 " 13.49 . . .	2,000	1.90	29.98	4,039	2.51	29.51
13.50 " 13.99 . . .	4,156	3.94	28.08	5,936	3.69	27.00
14.00 " 14.49 . . .	2,227	2.11	24.14	4,057	2.52	23.31
14.50 " 14.99 . . .	951	.90	22.03	2,004	1.25	20.79
15.00 " 15.49 . . .	5,099	4.84	21.13	7,560	4.70	19.54
15.50 " 15.99 . . .	834	.79	16.29	1,680	1.04	14.84
16.00 " 16.49 . . .	1,371	1.30	15.50	2,125	1.32	13.80
16.50 " 16.99 . . .	2,069	1.96	14.20	3,349	2.08	12.48
17.00 " 17.49 . . .	855	.81	12.24	1,437	.89	10.40
17.50 " 17.99 . . .	656	.62	11.43	1,173	.73	9.51
18.00 " 18.49 . . .	2,968	2.81	10.81	3,862	2.40	8.78
18.50 " 18.99 . . .	391	.37	8.00	612	.38	6.38
19.00 " 19.49 . . .	508	.48	7.63	655	.41	6.00
19.50 " 19.99 . . .	767	.73	7.15	970	.60	5.59
20.00 and over . .	6,782	6.42	6.42	8,014	4.99	4.99

Chart I contains the cumulative per cents. of 1890 and 1900, plotted in wage groups. The curve suggests (*a*) a slightly higher wage paid to the unskilled labor in the lower groups, and (*b*) quite as pronouncedly less to the better-paid workmen. These results are subject to two interpretations: (1) there may have been an actual rise and fall, as shown; or

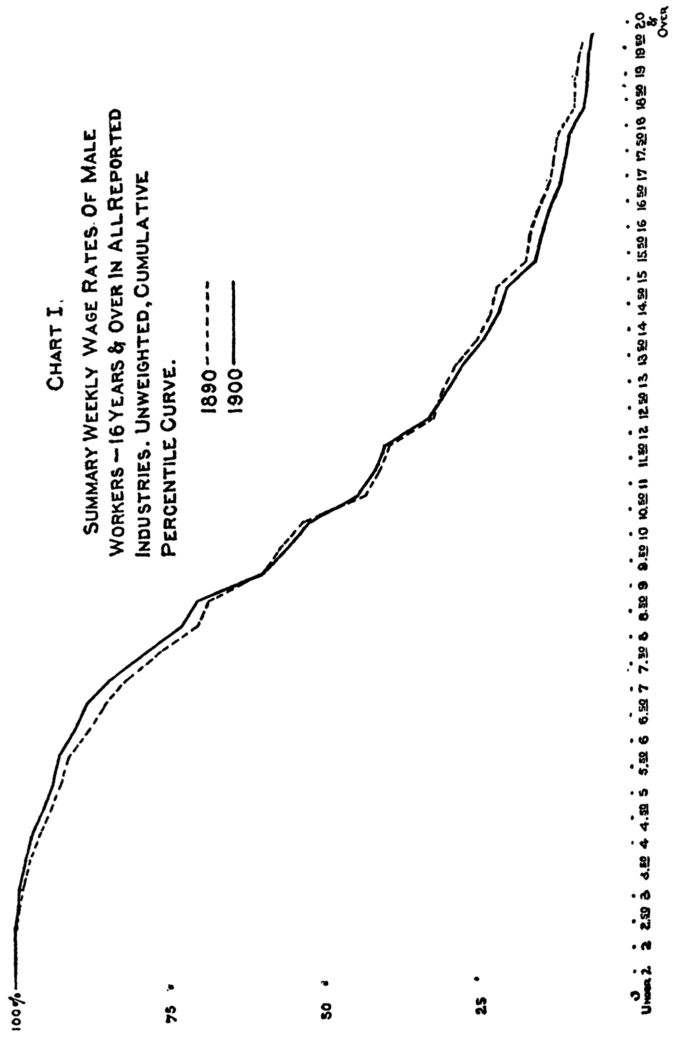

CHART I.

SUMMARY WEEKLY WAGE RATES OF MALE WORKERS—16 YEARS & OVER IN ALL REPORTED INDUSTRIES. UNWEIGHTED, CUMULATIVE PERCENTILE CURVE.

(2) the wage of every wage-earner may have remained the same, and the new labor introduced have entered the lower groups. In either case the results are equally unfavorable for the workers as a class.

But this method of obtaining a summary of the Dewey Report is open to serious objection. Although we know that the returns for most of our industries are truly representative, and that those which are not may safely be left to the theory of probability when combined, as here, to make so large a base, yet, if we grant the reliability of our returns for each industry, when a total summary is obtained, as above, we do not know that it is either reliable or representative. For we have thus far paid no attention to the relative importance of the industries thus combined. We may have given any industry reported fully by Professor Dewey far too much weight and much too little to those from which he secured comparatively few returns. Thus in Table II we have already noted that the per cent. of each industry returned varies for adult males from 32.38 per cent. of tobacco to .27 per cent. of brickyards employees. If our results are to be correct, they must give to each industry its rightful weight in accordance with the total number of workmen employed therein as reported by the 1900 Census of Manufactures, page 1, for the years 1890 and 1900. In the Dewey Report the total number of adult males whose rates of wages were secured is given for the entire industry for each year, divided up among the various wage groups. In the following table the total number actually employed in each industry, as returned by the Census, have been divided in the same manner, giving to each wage group the same proportion of the total as it has in the Dewey Report. This having been done for all the industries for each year, a summary was obtained for all industries, as before. The distribution in the wage groups of each industry is thus exactly as in the Dewey Report, but the total obtained by adding the various industries both contains all the wage-earners actually in those industries and gives to each industry its true weight.

TABLE VI.

Distribution of Adult Male Wage-earners in Wage Groups. Dewey's Report Weighted.

Rates per Week.	1890.			1900.		
	Number.	Absolute per Cents.	Cumulative per Cents.	Number.	Absolute per Cents.	Cumulative per Cents.
Total	1,788,966	100.00	100.00	2,232,509	100.00	100.00
Under $2.00	503	.03	100.00	975	.04	100.00
$2.00 to $2.49	3,163	.18	99.97	3,330	.15	99.96
2.50 " 2.99	5,337	.30	99.79	9,385	.42	99.81
3.00 " 3.49	21,555	1.20	99.49	20,653	.93	99.39
3.50 " 3.99	27,496	1.54	98.29	30,431	1.36	98.46
4.00 " 4.49	28,491	1.59	96.75	30,092	1.35	97.10
4.50 " 4.99	34,181	1.91	95.16	42,655	1.91	95.75
5.00 " 5.49	35,566	1.99	93.25	60,379	2.70	93.84
5.50 " 5.99	19,924	1.11	91.26	23,828	1.07	91.14
6.00 " 6.49	67,594	3.78	90.15	74,849	3.35	90.07
6.50 " 6.99	43,050	2.41	86.37	48,333	2.17	86.72
7.00 " 7.49	56,758	3.17	83.96	93,580	4.19	84.55
7.50 " 7.99	87,516	4.89	80.79	123,990	5.55	80.36
8.00 " 8.49	105,119	5.88	75.90	125,450	5.62	74.81
8.50 " 8.99	26,597	1.49	70.02	51,697	2.32	69.97
9.00 " 9.49	164,093	9.17	68.53	211,730	9.48	66.87
9.50 " 9.99	40,155	2.24	59.36	87,050	3.90	57.39
10.00 " 10.49	77,403	4.33	57.12	80,521	3.61	53.49
10.50 " 10.99	121,462	6.79	52.79	140,883	6.31	49.88
11.00 " 11.49	42,060	2.35	46.00	63,224	2,83	43.57
11.50 " 11.99	28,523	1.59	43.65	38,785	1.74	40.74
12.00 " 12.49	139,168	7.78	42.06	166,187	7.44	39.00
12.50 " 12.99	26,471	1.48	34.28	48,471	2.17	31.56
13.00 " 13.49	33,305	1.86	32.80	50,796	2.28	29.39
13.50 " 13.99	66,945	3.74	30.94	69,235	3.10	27.11
14.00 " 14.49	38,716	2.16	27.20	56 667	2.54	24.01
14.50 " 14.99	14,246	.80	25.04	24 537	1.10	21.47
15.00 " 15.49	99,658	5.57	24.24	104,985	4.70	20.37
15.50 " 15.99	12,523	.70	18.67	20,681	.93	15.67
16.00 " 16.49	29,046	1.62	17.97	32,991	1.48	14.74
16.50 " 16.99	30,390	1.70	16.35	42,125	1.89	13.26
17.00 " 17.49	16,213	.91	14.65	24,326	1.09	11.37
17.50 " 17.99	10,575	.59	13.74	14,093	.63	10.28
18.00 " 18.49	73,706	4.12	13.15	64,946	2.91	9.65
18.50 " 18.99	6,340	.35	9.03	7,341	.33	6.74
19.00 " 19.49	8,618	.48	8.68	9,144	.41	6.41
19.50 " 19.99	10,998	.61	8.20	10,563	.47	6.00
20.00 and over . . .	135,502	7.59	7.59	123,601	5.53	5.53

Plotting a curve with the above data as before, we have the curve shown in Chart II. This chart, which probably shows with reasonable accuracy the results which may be deduced from the Dewey Report as to adult male wage-earners, seems to indicate that wages were, on the whole, lower in 1900 than in 1890. Instead of, as before, a rise in the lower wage groups, we have here apparently no change

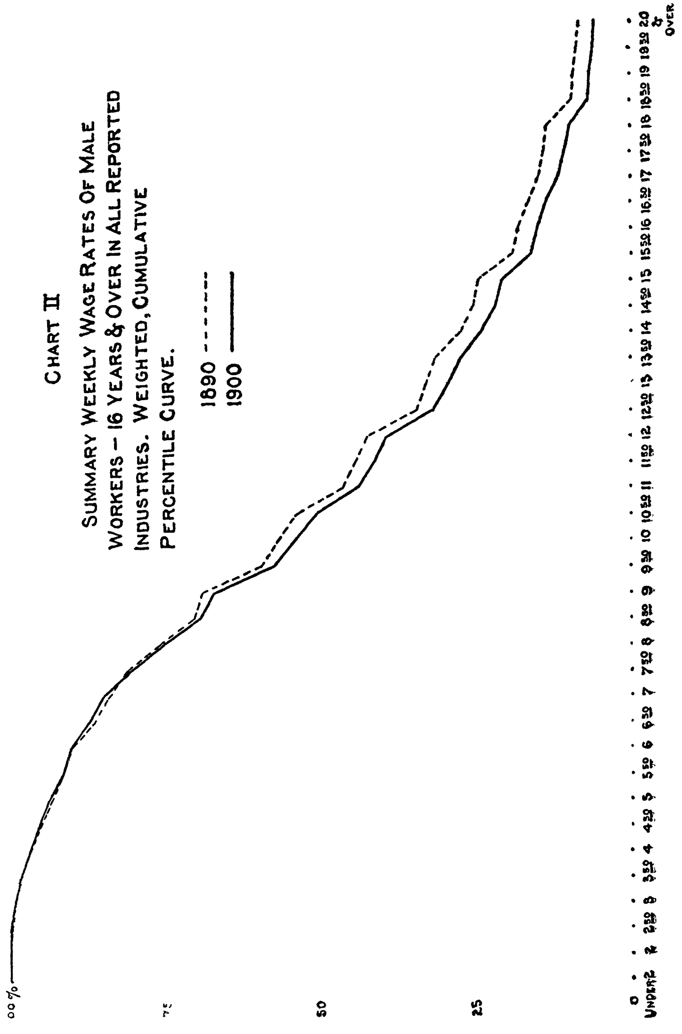

CHART II

SUMMARY WEEKLY WAGE RATES OF MALE WORKERS – 16 YEARS & OVER IN ALL REPORTED INDUSTRIES. WEIGHTED, CUMULATIVE PERCENTILE CURVE.

until about the 7.50 group, at which point the 1900 line falls below, and the distance between the two curves grows as we proceed into the higher groups. At the end of the curves the 1890 data show that 7.59 per cent. of the adult male wage-earners in manufactures were earning $20 or more per week, while only 5.33 per cent. were in that class in 1900. Moreover, as indicated in Table IV, the material for the Dewey Report was so selected that undue weight was given the one section of the country showing a material increase in wages in manufactures between the years 1890 and 1900. Thus the error in the collection of the data is opposed to the results obtained. What the correct results would have given we can only surmise, but certainly they would not have made a showing more favorable to the social well-being of the worker in 1900 than is made in Chart II.

However, it is still possible to make a further test of this result. It has already been pointed out that the method of restricting data secured for comparison to establishments returned in both years was unwise as tending to lessen the representative quality of the work. We have also intimated that Professor Dewey's returns are so broadly representative as probably not to be affected by the error in method. Fortunately, the men who did the work in the field when they found it convenient returned the 1900 pay-rolls of many establishments whose pay-rolls for 1890 could not be obtained. These results were tabulated separately for the industries in which they were secured, and added to the establishments for which comparative returns were given, the aggregate figures being presented in a supplement to the regular report under the caption "1900 Total." When to this is added the returns for 1900 of those industries from which extra returns were not obtained, the result gives us not merely a larger base, but it also furnishes an interesting test of the representativeness of the total already given. Table VII contains this result arranged in wage groups with their accompanying absolute and cumulative percentages, and the cumulative percentages for 1900 given in Table V are repeated in comparison with those of the total data for 1900.

This table includes those wage-earners tabulated for 1900 in the Dewey Report under the caption "1900 Total," and all others not therein included reported for 1900.

This table is surely a remarkable proof of the probable

TABLE VII.

THE DISTRIBUTION OF MALE WAGE-EARNERS SIXTEEN YEARS AND OVER, 1900.

Wage Groups.	Number.	Absolute per Cents.	Cumulative per Cents.	Cumulative Percentages of Table V.
Total	182,223	100.00	100.00	100.00
Under $2.00	36	.02	100.00	100.00
$2.00 to $2.49	138	.08	99.98	99.99
2.50 " 2.99	561	.31	99.90	99.92
3.00 " 3.49	1,403	.77	99.59	99.62
3.50 " 3.99	1,774	.97	98.82	98.91
4.00 " 4.49	2,127	1.17	97.85	97.96
4.50 " 4.99	2,997	1.64	96.68	96.87
5.00 " 5.49	2,981	1.64	95.04	95.25
5.50 " 5.99	1,606	.88	93.40	93.71
6.00 " 6.49	5,686	3.12	92.52	92.83
6.50 " 6.99	3,504	1.92	89.40	89.85
7.00 " 7.49	7,585	4.16	87.48	87.88
7.50 " 7.99	10,475	5.75	83.32	83.97
8.00 " 8.49	10,036	5.51	77.57	78.07
8.50 " 8.99	4,713	2.59	72.06	72.48
9.00 " 9.49	18,342	10.07	69.47	69.83
9.50 " 9.99	8,205	4.50	59.40	59.68
10.00 " 10.49	6,110	3.35	54.90	55.03
10.50 " 10.99	13,980	7.67	51.55	51.74
11.00 " 11.49	5,058	2.78	43.88	43.77
11.50 " 11.99	3,368	1.85	41.10	40.96
12.00 " 12.49	12,597	6.92	39.25	39.16
12.50 " 12.99	4,716	2.59	32.33	32.24
13.00 " 13.49	4,897	2.69	29.74	29.51
13.50 " 13.99	6,792	3.73	27.05	27.00
14.00 " 14.49	4,670	2.56	23.32	23.31
14.50 " 14.99	2,276	1.25	20.76	20.79
15.00 " 15.49	8,617	4.73	19.51	19.54
15.50 " 15.99	1,808	.99	14.78	14.84
16.00 " 16.49	2,451	1.35	13.79	13.80
16.50 " 16.99	3,725	2.05	12.44	12.48
17.00 " 17.49	1,634	.90	10.39	10.40
17.50 " 17.99	1,304	.72	9.49	9.51
18.00 " 18.49	4,395	2.41	8.77	8.78
18.50 " 18.99	662	.36	6.36	6.38
19.00 " 19.49	724	.40	6.00	6.00
19.50 " 19.99	1,153	.63	5.60	5.59
20.00 and over	9,117	4.97	4.97	4.99

accuracy of the Dewey Report. The addition of the wage data of nearly 22,000 wage-earners, or about 12.5 per cent. of the whole reported for the comparison in 1900, makes practically no difference in the result obtained. It therefore seems clear that the elaborate comparison of 1890 and 1900 was unnecessary, and that the results would have been the same, had each industry been carefully returned in each year without regard to the establishments from which these returns were secured. In other words, the accuracy of the return for each year and industry is the great end to be kept constantly in view, and to this all methods must be subordinate.

III.

The averages generally used for the presentation of wage statistics are the arithmetic average, the mode, and the median quartiles and deciles. In addition to these there is generally necessary some measure of dispersion, since the distribution of the wages at the various rates is quite as important as any average possibly can be. A simple measure of this kind is the formula, $\frac{Q^2 - Q^1}{Q^2 + Q^1}$, where Q^1 and Q^2 are the first and last quartiles. As a measure of distribution, the cumulative percentile curve used in this paper has several valuable features. It not only gives the entire data in the original form, and thus permits us to locate changes at any and every point, but it possesses the advantage of all graphic representations, that its significance is easily grasped at a glance. For this reason no further study has been made of distribution or of the medians and other percentile averages.

Next to be considered are the arithmetic average and the mode as applied to the Dewey Report. The arithmetic average in wage statistics is at present somewhat discredited by careful statisticians. Certainly, the average possesses few attributes of value for the student who views wages from the social side. The wages of two men, one of whom receives 20 and another 30 cents an hour, mean an altogether different thing from the wages of two men one receiving 5 cents and the other 45; yet the averages are identical. On the other hand, we know that the arithmetic average, the median, and the mode in an absolutely natural distribution meet at the same point; and to get the arithmetic average in connection with our other averages, and not as a substitute for them, makes possible an interesting comparison of our data with the ideal frequency curve. For this reason I have endeavored to get approximate arithmetic averages for the two years under consideration. I have multiplied the centre amount ($2.25, $2.75, $3.25) in each wage group by the number in that group, added the amounts so obtained for each year, and divided by the total number of employees, thus getting an average weekly rate of wage. The group under $2 I placed at $1.75, and that over $20 at $24. The averages so obtained for the weighted data were for 1890 $11.41 and for 1900 $11.32. This average is, I feel certain, a maximum, and the minimum I would locate not far from $11.16 and $11.07 for 1890 and 1900, respectively. These minima are the results which would be obtained by computing the average from the lower limit of each wage group instead of from the middle point. This average is, it will be noted, for each year higher than the median, and it is also higher than the mode. The reason for this is the tremendous weight which is given in the computation of an arithmetic average to the wages of the better paid workmen.

The mode as applied to wage statistics may be defined as "the style in wages." It is that wage received by a greater number of employees than is any other. It is of particular importance in wage data, as indicating the *typical* man. Thus the percentile points and the arithmetic average neglect absolutely the question of concentration or density, and may fall where there are practically no wage-earners whatsoever. A glance over a Report of the Bulletin of Labor is as good as a trip to a department store bargain counter. Such wages as $1.47 per day, etc., are quite the rule. Yet who ever heard of a workingman knocking down his day's labor at $1.98 or $1.49? The mode as applied to the Dewey Report has been a most interesting study. Absolute per cents. are given in Table VI above, and these are plotted in the ordinary frequency curve for both years in Chart III.

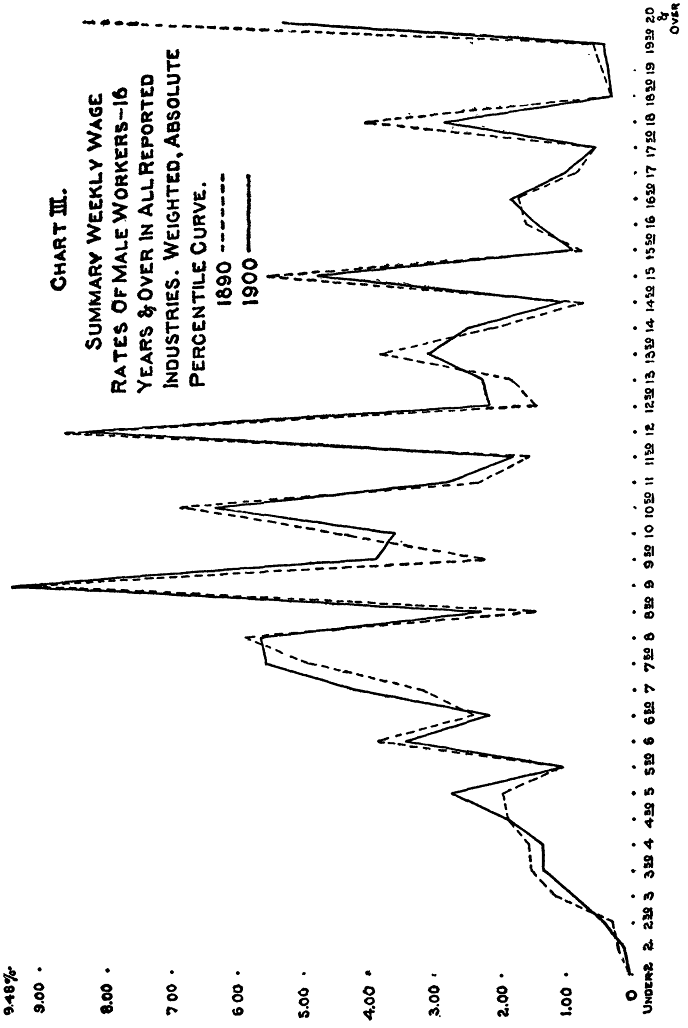

CHART III.
SUMMARY WEEKLY WAGE RATES OF MALE WORKERS—16 YEARS & OVER IN ALL REPORTED INDUSTRIES. WEIGHTED, ABSOLUTE PERCENTILE CURVE.
1890 - - - - - - -
1900 ———————

The absolute irregularity of the figure is such that no results can be safely deduced therefrom as indicating the mode. There seem to be at least four prominent modes and many lesser ones. The $9 group stands out most prominently, but without further investigation we can hardly locate the mode at that point. Another test must therefore be applied. Thus far we have dealt with our data wholly in 50-cent groups. But it is possible by simple addition to get it into $1, $1.50, $2, or other groups which are multiples of 50 cents. Our object in so doing is to secure regularity in our data, and this is finally obtained in the $3 grouping. The numbers of wage-earners from Table VI thus combined for both 1890 and 1900 into $3 groups are given in Table VIII; and, since there

TABLE VIII.

DISTRIBUTION OF MALE WAGE-EARNERS SIXTEEN YEARS AND OVER IN $3 WAGE GROUPS.

Rates a Week.	1890.	1900.	Rates a Week.	1890.	1900.
Under $2.00	503	975	Under $2.50 . . .	3,666	4,305
$2.00 to $4.99 . . .	120,223	136,546	$2.50 to $5.49 . . .	152,626	193,595
5.00 " 7.99 . . .	310,408	424,959	5.50 " 8.49 . . .	379,961	490,030
8.00 " 10.99 . . .	534,829	697,331	8.50 " 11.49 . . .	471,770	635,105
11.00 " 13.99 . . .	336,472	436,698	11.50 " 14.49 . . .	333,128	430,141
14.00 " 16.99 . . .	224,579	281,986	14.50 " 17.49 . . .	202,076	249,645
17.00 " 19.99 . . .	126,450	130,413	17.50 " 19.99 . . .	110,237	106,087
20.00 and over . . .	135,502	123,601	20.00 and over . .	135,502	123,601
Under $3.00	9,003	13,690	Under $3.50 . . .	30,558	34,343
$3.00 to $5.99 . . .	167,213	208,038	$3.50 " $6.49 . . .	213,252	262,234
6.00 " 8.99 . . .	386,634	517 899	6.50 " 9.49 . . .	483,133	654,780
9.00 " 11.99 . . .	473,696	622,193	9.50 " 12.49 . . .	448,771	576,650
12.00 " 14.99 . . .	318,851	415,893	12.50 " 15.49 . . .	279,341	354,691
15.00 " 17.99 . . .	198,405	239,201	15.50 " 18.49 . . .	172,453	199,162
18.00 " 19.99 . . .	99;662	91,994	18.50 " 19.99 . . .	25,956	27,048
20.00 and over . . .	135,502	123,601	20.00 and over . .	135,502	123,601
Under $4.00	58,054	64,774	Under $4.50 . . .	86,545	94,866
$4.00 to $6.99 . . .	228,806	280,136	$4.50 to $7.49 . . .	257,073	343,624
7.00 " 9.99 . . .	480,238	693,497	7.50 " 10.49 . . .	500,883	680,438
10.00 " 12.99 . . .	435,087	538,071	10.50 " 13.49 . . .	390,989	508,346
13.00 " 15.99 . . .	265,393	326,901	13.50 " 16.49 . . .	261,134	309,096
16.00 " 18.99 . . .	166,270	185,822	16.50 " 19.49 . . .	145,842	161,975
19.00 " 19.99 . . .	19,616	19,707	19.50 " 19.99 . . .	10,998	10,563
20.00 and over . . .	135,502	123,601	20.00 and over . .	135,502	123,601

are six 50-cent groups in each $3 group, it is possible, by shifting the point at which we begin to collect our groups, to get six different groupings of our data.

It will be noted that the mode in each one of the different groupings covers slightly different 50-cent groups.

These are

6.50	9.49
7	9.99
7.50	10.49
8	10.99
8.50	11.49
9	11.99

and, on the whole, only one 50-cent group is common to all the $3 model groups. That is the $9 to $9.49 group. Therefore, the mode may fairly be said to be in that group, and the typical male American factory worker may perhaps be said to be shown by the Dewey Report to be the man who receives $1.50 a day. No change appears in the mode between the two years.

This study of the mode brings out a most interesting phenomenon in connection with the grouping of wage-earners. I have already spoken of the absolute irregularity of the curve in Chart IV. It remains to be noted that there is a remarkable regularity in this irregularity. The groups which stand out above the others as most prominent modes or points of concentration are the $5, $6, $8, $9, $10.50, $12, $13.50, $15, $16.50, and $18 groups. Of these only the $5 and $8 groups are not multiples of 3 × 50 cents. We are already familiar with the concentration in age statistics upon the years which are multiples of 5. It would seem that there is some similar concentration in wage statistics, if our returns are sufficiently numerous to prevent accidental groupings. Mr. Bowley, in his "Elements of Statistics," p. 147, says: "Average earnings for a year will not be reckoned exactly by shillings or even pence. If we had a sufficient number of instances, we should get regular sequences of earners at successive farthings, and the line representing them would have no sharp angles, but be continually curved." If the statement were merely that, it would not be open to criticism; but it is applied to a diagram showing *rates per week*, which exhibits almost the same phenomena as those presented in Chart IV. Whether 160,000 workers is a number sufficiently large to give "regular sequences," if such things really were inherent in our data, we will leave to our reader to judge. But may it not be possible that there are actually certain points of concentration in wage statistics? And, if this be true, it only remains to explain this concentration, derive the rule which governs it, and learn if it be actually true and inherent or merely error, like the concentration in age statistics. The reason lies, it would seem, in the factory system of wage payment. Payment is made, for the most part, in multiples of ½ cents an hour, and there would seem to be concentration on 5 × ½ cents and the multiples thereof. In other words, in week rates this means concentration on 30 cents and its multiples, with emphasis on the 5 multiples of 30 cents or the multiples of $1.50. This explains the concentration on all but the $5 and $8 groups, and shows why at $10.50 there are nearly twice as many as at $10. The $5 and $8 groups, however, contain *two* multiples of 30 cents,—namely, $5.10 and $5.40, and $8.10 and $8.40; and all the groups which contain but one multiple of 30 cents are those groups in which there are but few wage-earners. In other words, the method of wage payment in use in American factories has entirely destroyed the regularity of the wage curve, and has created artificial modes at the various multiples of 5 × 30 cents, and there is a concentration on all the 30-cent multiples to a greater or less degree.

The grouping chosen by Professor Dewey was, unfortunately, such as to exaggerate this concentration. Of every three 50-cent groups, two contain two multiples of 30 cents, and one only one multiple. Thus in each of the groups which contained two multiples there tended to be twice the number of employees that there were in the group containing one multiple of 30 cents only. At first thought, indeed, it would seem that the data should have been arranged in 30-cent instead of 50-cent groups, in order that the irregularity of the groups might be reduced; but, on the other hand, we must remember that the sole object of grouping the data is to render it more intelligible and convenient, and surely a 30-cent arrangement would be necessarily clumsy and confusing. Moreover, the 30-cent multiple group itself depends entirely upon the number of hours in the day's labor, and a change to nine hours from ten would give us the impossible 27-cent grouping as a logical result of our rule. On the whole, a grouping which fits evenly into the unit of our monetary system would seem to be the most convenient and desirable. Whether a 50-cent group is small enough is perhaps questionable; but, in view of the facts already presented, the value of a smaller one would perhaps be doubtful. A 10-cent group would be too small. A 25-cent basis would possess all the faults of the 50-cent one with no compensating features except that only one multiple of 30 cents could be contained in the group. Certainly, for purposes of social investigation the 50-cent group is small enough.

But another question arises in connection with this concentration on these points which is very embarrassing to the theoretical statistician. This is the matter of smoothing the curve. In Mr. Bowley's work, to which I have already referred is found, p. 154, the following discussion of a cumulative curve plotted from the data of the Aldrich Report, in which occur the same phenomena which we have found in those of the Dewey Report: "The irregularities shown by the thin line" (an unsmoothed line of absolute cumulative groups similar to those used in this paper) "do not arise from any law of wage grouping, but are due to the accidents of observation; if we regard these returns as samples out of a much larger unregistered group, we may suppose that a smoothed curve will indicate approximately the form which would be obtained if our returns were complete." Proceeding upon the theory enunciated above, Mr. Bowley applied to his data certain methods of interpolation, the result of which is a beautifully smoothed curve. But we have already pointed out that these irregularities do arise from a law of wage grouping. They are not due to the accidents of observation, and therefore we may not suppose that returns from every establishment in the country would give us a smoothed curve. If this be the case, is it not true that for correct statistical purposes we may neither smooth the curve nor interpolate? The purpose of smoothing the curve should be to eliminate error, and not to disguise the truth. For this purpose we smooth periodic curves and the age curve. But the irregularities of the wage curve are truth. Wage rates do concentrate about certain definite points, and to assume an even distribution is to assume a thing which is unwarranted by the facts. Moreover, it is customary to estimate the median and other percentile points "accurately" by this graphic method. Thus in Chart II we may locate the median at $10.50 and $10.73, respectively, for 1900 and 1890. Yet we are morally certain that in both years nearly every man in that group received $10.50, and our median so found is worthless. For instance, there might have been a change within the group, say the concentration in 1890 was on $10.50, in 1900 $10.80, yet the group would remain the same, and the medians show a fall instead of a rise. For this reason the use of the smoothed curve or of interpolation in cases of this kind is extremely dangerous, and is likely to mislead. The concentration, while due to our monetary system, is true, and is there, and the statistician has no right to smooth it out of existence.

We have examined in detail some of the most important parts of the Dewey Report. Much has been left untouched. The report gives statistics of wage rates for women and for male and female children. It gives rates per hour and earnings in a week for all classes of labor investigated. Thus our study has by no means exhausted the rich mine of information contained in this excellent report. Summaries of week rates similar to that contained in Table V were made for women and children, but, because of lack of space and the comparative unimportance of the results obtained, these summaries have been omitted from this paper. Indeed, in view of the present chaotic state of wage statistics in this country, results in any investigation are of less importance than the methods used and the statistical points made clear. While I believe that the Dewey Report shows clearly that adult male wage-earners in manufactures earned less in 1900 than in 1890, I think it is of vastly greater importance to remember that that report has brought to the fore the wage group and the percentile summary,—methods that are far superior to any others yet devised to indicate by statistics of wages the welfare of the laboring class.